CLAIMS

- 1. A method of kinetic spray coating a substrate comprising the steps of:
 - a) providing particles of a powder;
- b) injecting the particles into a gas/powder exchange chamber and entraining the particles into a flow of a main gas in the gas/powder exchange chamber, the main gas at a temperature insufficient to heat the particles to a temperature above a melting temperature of the particles;
- c) directing the particles entrained in the main gas in the gas/powder exchange chamber into a powder/gas conditioning chamber having a length along a longitudinal axis of equal to or greater than 20 millimeters; and
- d) directing the particles entrained in the flow of gas from the conditioning chamber into a converging diverging supersonic nozzle, thereby accelerating the particles to a velocity sufficient to result in adherence of the particles on a substrate positioned opposite the nozzle.
- 2. The method as recited in claim 1, wherein step a) comprises providing as the particles at least one of an alloy, a metal, a ceramic, a polymer, a metal coated ceramic, a semiconductor, or mixtures thereof.
- 3. The method as recited in claim 1, wherein step a) comprises providing particles having an average nominal diameter of from about 1 microns to 250 microns.
- 4. The method as recited in claim 1, wherein step b) comprises injecting the particles under a pressure that is from about 5 to 300 pounds per square inch above a pressure of the main gas.
- 5. The method as recited in claim 1, wherein the main gas is at a temperature of from about 200 to 1000 degrees Celsius

- 6. The method as recited in claim 1, wherein step b) comprises injecting the particles parallel to a longitudinal axis of the gas/powder exchange chamber.
- 7. The method as recited in claim 1, wherein step b) comprises injecting the particles at one of an oblique angle relative to a longitudinal axis of the gas/powder exchange chamber or at a tangential angle relative to the gas/powder exchange chamber.
- 8. The method as recited in claim 1, wherein step c) comprises directing the entrained particles into a powder/gas conditioning chamber having a longitudinal axis of from about 20 millimeters to about 1000 millimeters.
- 9. The method as recited in claim 1, wherein step d) comprises accelerating the particles to a velocity of from about 200 to about 1500 meters per second.
- 10. The method as recited in claim 1, wherein step d) comprises providing a substrate comprising at least one of a metal, an alloy, a plastic, a polymer, a ceramic, a wood, a semiconductor or a mixture thereof.
- a gas/powder exchange chamber, a powder/gas
 conditioning chamber, and a converging diverging supersonic nozzle;
 said conditioning chamber having a length along a
 longitudinal axis equal to or greater than 20 millimeters; and
 said conditioning chamber positioned between said
 exchange chamber and said supersonic nozzle with said conditioning chamber
 in communication with said exchange chamber and said supersonic nozzle.

- 12. The kinetic spray nozzle system as recited in claim 11, wherein said conditioning chamber has preferably a circular cross-sectional shape.
- 13. The kinetic spray nozzle system as recited in claim 11, wherein said length along said longitudinal axis is from about 20 millimeters to about 1000 millimeters.
- 14. The kinetic spray nozzle system as recited in claim 11, further comprising a particle injector tube in communication with said exchange chamber.
- 15. The kinetic spray nozzle system as recited in claim 14, wherein said injector tube has a longitudinal axis that is parallel to a longitudinal axis of said gas/powder exchange chamber.
- 16. The kinetic spray nozzle system as recited in claim 14, wherein said injector tube has a longitudinal axis that is one of at an angle of 90 degrees with respect to a longitudinal axis of said gas/powder exchange chamber or at a tangential angle relative to the gas/powder exchange chamber.
- 17. The kinetic spray nozzle system as recited in claim 14, wherein said injector tube has an internal diameter of from about 0.3 to about 3.0 millimeters.
- 18. The kinetic spray nozzle system as recited in claim 11, wherein said converging diverging supersonic nozzle has a throat with a diameter of from about 1.0 to about 5.0 millimeters.

- 19. The kinetic spray nozzle system as recited in claim 11, wherein said conditioning chamber releasably engages said gas/powder exchange chamber and said converging diverging supersonic nozzle
- 20. The kinetic spray nozzle system as recited in claim 19 wherein said conditioning chamber includes a plurality of threaded portions, one of which releasably engages a corresponding threaded portion on said gas/powder exchange chamber and another of which releasably engages a corresponding threaded portion on said converging diverging supersonic nozzle.